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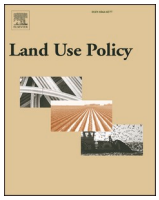

Amenity-based development and protected areas in the American West

Evan Hjerpe [a,*], Christopher A. Armatas [b], Michelle Haefele [a,c]

[a] Conservation Economics Institute, Twin Falls, ID, USA
[b] Aldo Leopold Wilderness Research Institute, Rocky Mountain Research Station, USDA Forest Service, Missoula, MT, USA
[c] Colorado State University, Fort Collins, CO, USA

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ABSTRACT

The amenity migration phenomenon and outdoor recreation growth has led to rapid amenity-based development of many gateway communities in the American West, particularly in regions adjacent to protected public lands. This amenity-based development typically enhances traditional regional economic indicators of income, employment, and taxes but can result in run-away housing costs, a hollowing out of income distribution, residential sprawl, and conflict among long-term residents and new arrivals. However, little research has focused specifically on how such migration and the existence of public lands is leading to the development of rural communities. To address this gap in the literature, we conducted econometric analysis to determine which natural amenities, including types of public lands and protected areas, were most associated with levels of amenity-based development in the rural West. We utilize the Destination Development Scale (DDS), an index of migration rates, housing values, and seasonal housing, to rank and regress the amenity development level of 356 non-metro counties. Spatial regressions illustrate that a county's amenity-based development level is most influenced by cool summers, varied topography, forests, water, and regional access. Rural counties with more Wilderness and National Monuments were most highly associated with greater amenity-based development and all six protected area types showed higher DDS scores. Understanding the natural amenities that most influence the economic demand for rural destinations can inform regional planning efforts, helping to prioritize policies that balance conservation and development.

1. Introduction

Amenity migration, or the movement of people to mostly rural areas for environmental and lifestyle reasons, is a complex phenomenon that is particularly prevalent in the American West. The phenomenon is characterized by various motivations or causes (e.g., recreation, scenery, escape from corporate culture), social implications (e.g., conflict between long-time residents and newcomers, reorganization of political power, changes in community satisfaction), economic implications (e.g., increase in seasonal jobs, more tax revenue, higher housing costs), and environmental implications (e.g., habitat fragmentation, impediment to natural fire regime restoration) (Gosnell and Abrams, 2011; Abrams et al., 2012). The amenity migration phenomenon and the associated need for sustainable rural planning represents a 'wicked problem', which is characterized by deep differences in values, multiple conceptualizations of the problem and its potential solutions, scientific uncertainty, and diverse effects across spatial and temporal scales (Rittel and Webber, 1973; Balint et al., 2011; Davies et al., 2015).

Policy, planning, and management of social-ecological systems within the context of amenity migration will require knowledge spanning the social, ecological, and economic sciences. Indeed, the amenity migration phenomenon has been studied extensively for over 40 years (Abrams and Bliss, 2013; Matarrita-Cascante, 2017), within a diversity of research traditions (e.g., rural sociology, geography, conservation biology, and economics) and associated research methods (e.g., in-depth interviews, surveys, analysis of extant socio-demographic statistics). While much of the foundational literature focused on the causes and consequences of amenity migration, more recent research has focused on topics such as community level factors that lead to positive outcomes after experiencing amenity migration (Matarrita-Cascante, 2017), potential ways to address planning and development challenges (Stoker et al., 2020), perceptions of different types of residents toward community development and change (Ulrich-Schad, 2018, Park et al., 2019, Stiman, 2020), the implications of amenity migration for energy consumption (Winkler and Matarrita-Cascante, 2020), and whether climate change and catastrophic wildfires are altering amenity migration

* Correspondence to: P.O. Box 5454, Twin Falls, ID 83303, USA.
E-mail address: evan@conservationecon.org (E. Hjerpe).

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patterns (Winkler and Rouleau, 2020).

Within the context of the broad amenity migration literature, we focus on the knowledge gap related to the influence of public lands and federally protected areas in the American West on 'amenity-based development'–defined herein as the economic demand for natural amenities as illustrated by economic outcomes in mostly rural communities such as percent of seasonal home ownership, housing prices, *and* migration rates (Winkler, 2010), as opposed to focusing only on relocation rates. At the county or regional level, a significant amount of research has shown that public lands generally (Mockrin et al., 2018) and particularly protected areas,[1] natural amenities (e.g., climate, topography), and outdoor recreation opportunities are strongly associated with the migration of people to such areas (Power, 1991; Rasker, 1993; McGranahan, 1999). With regard to particular protected areas, the presence of Wilderness Areas and National Monuments in the western U.S. have been shown to be significant drivers of amenity migration since 1980 (Hjerpe et al., 2020).

However, little research has focused specifically on how such migration and the existence of public lands is leading to the development of rural communities. Therefore, it is challenging to know if regions with the greatest in-migration rates also experience the greatest amenity-based development and vice versa, or which types of protected areas are most highly associated with amenity-based development. This lack of understanding represents a gap within the broad understanding of the amenity migration phenomenon, which is likely important for both decision-making and the mediation of stakeholder values within the context of planning and policy around both protected areas and the nearby communities in the American West. For instance, if protected areas are associated with greater amenity-based development, this would be further evidence that such designations are integral to the economies of nearby communities. More specifically, if particular types of designations such as Wilderness (where extractive uses are generally limited) are shown to support amenity-based development, then greater nuance can be added to the discussion about the costs and benefits of such designations. For local community planners, a better understanding of what drives amenity-based development can support the decision about community marketing and branding. At a broader policy level, understanding whether protected areas are associated with amenity-based development is important because, contrary to climatic, geographic, and most natural amenities, protected areas are a social overlay to the land that can be expanded or contracted.

This paper proceeds with a brief review of the existing literature related to amenity-based development and protected areas. In Section 2, we present the methods of econometric analysis used to understand the association between natural amenities and a county's amenity-based development level, and present results in Section 3. Section 4 includes a discussion of the implications of this research for sustainable rural planning and the mediation of stakeholder values.

1.1. Literature review

Starting in the 1980s, and gathering steam in the 1990s, amenity migration across the American West (hereafter, the West) led to new boom towns. The amenity-based development experienced in the rural West was based on drawing migrants, seasonal residents, and tourists to enjoy a region's public lands and environmental quality (Rudzitis, 1993; Power, 1996). Increasing participation in outdoor recreation helped fuel these amenity boom towns and the exported commodities changed from minerals and timber to jagged peaks, powdery snow, and alpine lakes. Intensive amenity-based development contributed to economic structural changes across the West, where communities began to shift from extractive-based economies to service-based economies leading to a "New West" (Riebsame et al., 1997, Beyers and Nelson, 2000). This shift created regional economic winners and losers as migrants were no longer strictly following employment opportunities but were capitalizing on financial resources to pursue greater quality of life and recreational activities in high amenity regions (Power, 1988; Rasker, 2006). Regions with the highest level of natural amenities saw an influx of new residents, while regions with less amenities may have experienced flat or declining populations. Largely fueled by non-labor and transfer income[2] (Rasker and Hansen, 2000), this shift in wealth based on intensive amenity-based development was a boon to local tax coffers and regional growth for the most developed communities. However, excessive amenity-based development can threaten the very things that serve as attractants in the first place, like open space, protected areas, and the idylls of the rural (Marcouiller, 1997).

Protected areas in the West, including National Parks, National Monuments, and Wilderness Areas, have been shown to attract tourists and migrants (Hjerpe et al., 2020), boost regional economic impacts (Holmes and Hecox, 2004), and are a centerpiece to amenity-based development strategies (Power and Barrett, 2001). Researchers have analyzed various aggregations of protected areas in the West and have consistently found that regions with protected areas were associated with greater population and income growth (Rudzitis, 1996, Shumway and Shumway and Otterstrom, 2001, Lorah, 2000, Lorah and Southwick, 2003, Dearien et al., 2005).[3] Likewise, others have shown that people are willing to pay to gain proximity to protected areas (Hand et al., 2008, Izón et al., 2010, 2016) and a recent examination of western National Monuments found increases in regional businesses and jobs after designation (Walls et al., 2020).

The implications of amenity-based development, within the context of economic, ecological, and social sustainability, are numerous. Reflected in recent surges in amenity-based development is rapid housing growth adjacent to protected areas that is threatening the effectiveness of conservation goals (Radeloff et al., 2010). The increased growth rates near protected areas are not just a U.S. phenomenon but are also occurring internationally (Wittemyer et al., 2008) and recent research indicates that the demand for amenities and access to public lands is increasing (Kim and Marcouiller, 2021). Recreational and second-home ownership near protected areas can exacerbate environmental concerns and isolate biodiversity (Kondo et al., 2012). When recreational housing becomes too great, community economic well-being declines (Winkler et al., 2015). While amenity newcomers tend be supportive of conservation policies (Rudzitis, 1999), many of their actions such as contributing to unfettered rural sprawl are counter to the values afforded by protected areas (Hansen et al., 2002). The paradox of amenity migrants populating undeveloped lands in search of isolation (Kondo et al., 2012), and the unintended environmental consequences and redistribution of amenity-based development benefits (Abrams et al., 2012), calls for greater deliberation of land use policies and greater information on the role of protected areas in amenity-based development.

Communities adjacent to protected areas understand the wealth-attracting force of unspoiled nature, and market and brand their

[1] Protected areas are defined here as public lands with specific designations that preserve the lands in a more natural state and limit or exclude development and extractive uses. We focus on federal protected areas, though we acknowledge that there are other types of protected areas such as Tribal and State protected areas. We also acknowledge that some federal protected areas, such as Wild and Scenic Rivers, often have state and private lands interspersed.

[2] Transfer income includes direct payments for income support along with income from investments and rent.

[3] A couple of studies have found that protected areas had no effect, positive or negative, on surrounding economic indicators. Duffy-Deno (1998) found no effect for Wilderness lands and employment and population growth in the Inter-Mountain West, though he excluded Wilderness on NPS and USFWS managed lands and aggregated Wilderness Study Areas with Wilderness Areas. Jakus and Akhundjanov (2019) found no effect from National Monuments designations on changes in per capita income.

communities accordingly. However, to support prudent amenity-based development and land use policies, greater information is needed to better protect nature, sustain rural livelihoods, and retain the very essence of natural amenities—open space, clean air, and pleasurable esthetics—that comprise the entire basis of initial migrant attraction (e.g., Bergstrom, 2018). That is, approaching amenity-based development as a panacea to rural poverty and stagnation is not recommended (Marcouiller et al., 2004).

Some contend that the social production of a place as a destination and associated social amenities can be as influential in attracting migrants as natural amenities themselves (e.g., Winkler, 2010). To wit, a case study in rural Pennsylvania found that local promotion of recreation and tourism resulted in increased housing prices and net migration (Humphrey and Wilkinson, 1993) and recent marketing campaigns in Utah successfully attracted out-of-state visitors to southern Utah national parks (Drugova et al., 2020). But rural areas, as opposed to more populated regions, are often not as well prepared to deal with rapid increases in growth, as they typically have been subject to few land constraints leading to low density development and sprawl (Marcouiller et al., 2002). Marcouiller et al. (2002) suggest that rural communities tend to lack planning resources, value landscapes with less regulation, and have a greater desire for growth as a few factors for why rural areas can struggle with amenity-based development.

So, while amenity-based development based largely on protected areas and conservation typically results in improved economic metrics such as regional tax revenues, per capita income, income growth, and employment (Rasker and Hackman 1996, Deller et al. 2001; Rasker et al., 2013), these changes may impact some negatively. A strict focus on traditional market indicators of income and employment growth associated with tourism and amenity-based development neglect other key rural economic structural components such as the distribution of benefits and a "hollowing out" of income distribution (Marcouiller et al., 2004). Rapid increases in housing costs can render high amenity regions unaffordable for middle-income families and the regional workforce (Marcouiller and Green, 2000). Amenity-based development near protected areas can lead to depressed wages and more seasonal work as compared to traditional extractive industries (Green et al., 2005) and can stress regional emergency services and transportation infrastructure (Eagles et al., 2002; Hjerpe and Kim, 2007). Additionally, changing social, ethnic, and cultural patterns related to amenity-based development and public lands are deserving of greater deliberation and consideration (Mockrin et al., 2018).

A review of the literature indicates that amenity-based development tends to yield net benefits, economically and ecologically (via an influx of more conservation-oriented newcomers), up to a certain point and then is followed by diminishing marginal returns once past the inflection point. As protected areas and conservation campaigns are influential on the adjacent level of amenity-based development, greater knowledge on trajectories and patterns of gateway communities can be used to construct regional development planning in concert with conservation planning. To this point, conservation planning has been conducted first, with regional development planning lagging behind and typically being reactionary in nature and often too late.

2. Methods

We adapt and update Winkler's (2010) Destination Development Scale and regress a suite of natural amenity and protected area indicators on this dependent variable. We examine descriptive statistics for various types of protected areas to understand how each type of protected area interacts with our amenity-based development scale. Our study focuses on mostly rural counties, excluding large metro areas, in the American West due to the high level of public lands and amenity migration that has occurred in the region over the last few decades.

2.1. Model specification

To help explain why certain Western counties are greater "destinations" for relocation than others, we start by constructing a common metric to evaluate the level of a region's amenity-based development. Winkler (2010) developed the Destination Development Scale (DDS) from Census 2000 data, a simple aggregate index that combines three measures of amenity-based development outcomes at the county level: 1) the percent of seasonal or second home ownership; 2) the percent of homes values over $200,000; and 3) the five-year in-migration rate from more urban areas. Because Winkler's (2010) DDS is based on data from 1995 to 2000, we updated the scale to 2005–2010 using the Census 2010 data and present regression analyses based on both the original DDS and the updated DDS.

Using five-year in-migration rates from more urban areas for the DDS, as done by Winkler (2010), provides a snapshot in time of recent amenity-based development. While this is important information, five-year migration rates can produce an incomplete picture of how rural areas have been developing over longer periods of time. For example, the original DDS incorporates in-migration rates from 1995 to 2000 which happens to be during the peak of rural Western amenity migration. In updating the DDS to 2010, we use a five-year migration window from 2006 to 2010 which happens to coincide with overall reduced amenity migration in the rural West (as compared to the 1990s) and is centered upon the Great Recession of 2008. While both the original and updated DDS provide useful information, they represent snapshots in time and could be improved by incorporating longer timeframes for migration rates. Likewise, using migration rates only for people relocating from more urban areas excludes migrants who may be coming from another rural area but are looking to upgrade their rural quality of life.

While we retain and analyze the original (2000) and updated (2010) DDS, we make our own adaptations to the DDS to come up with a preferred model. A more complete DDS can be constructed by incorporating long-term migration rates in order to smooth out peaks and valleys in migration that may occur in the short run. Thus, we use 20-year county migration rates from 1990 to 2010 for all migrants (from metro and rural areas) as our migration component in our adapted DDS. For the housing cost and seasonal ownership variables, we use measurements from 2010. We update the housing cost variable for 2010 to the percentage of houses valued over $300,000. While these two variables are also a one-time snapshot, they are representative of cumulative and ongoing second home ownership and housing cost variables rendering them useful as long-term equivalent metrics. For example, housing prices generally increase over time, but even short-term decreases tend be broadly distributed across space and housing prices at any given time offer adequate relative comparisons of the cost of living in rural counties. Based on a Cronbach's alpha score of.636, our adapted DDS index exhibits internal consistency and is a reliable indicator of amenity-based development (Ursachi et al., 2015).

In our model specification we assume that the level of amenity-based development, represented by the DDS, is primarily a function of the level and type of natural amenities contained in each Western county. That is,

$$\mathbf{AD} = \mathbf{F}\ (\mathbf{N}_a) \tag{1}$$

where AD is amenity-based development and N_a represents a suite of natural amenities. However, natural amenities such as geographic and climatic features of a region are not political or societal constructs and are largely uncontrolled by humans. Adding the social component to natural amenities results in land that is managed by particular rules. Protected areas, and public lands, can be considered as designated natural amenities, where biophysical attributes can be governed by locational use zones. Additionally, built amenities like regional infrastructure and ski resorts, can facilitate access and enhance recreational opportunities, which influence a region's development pattern. A more

comprehensive model specification that includes these other amenities can be illustrated as,

$$\mathbf{AD}_i = \mathbf{F}\ (\mathbf{N}_a, \mathbf{DN}_a, \mathbf{B}_a) \quad (2)$$

where AD_i is the level of amenity-based development, which in our model is the DDS value, for the i^{th} county in the analysis, and is broadly a function of county attributes including geographic and climatic natural amenities (N_a) such as average temperatures and topography, designated amenities (DN_a) such as protected areas and the amount of public land managed by federal land agencies, and the most prominent built amenities (B_a) like transportation infrastructure and ski resorts.

Econometrically, our model is represented as,

$$\mathbf{DDS} = \boldsymbol{c} + \beta(\mathbf{X}) + \varepsilon$$

where **DDS** is the county's level of amenity-based development, $\boldsymbol{c}$ is a vector of constants, **X** is a vector of a county's natural and built amenity attributes (N_a, DN_a, B_a), **β** is the vector of coefficients, and **ε** is a vector of error terms.

The natural amenities used for explanatory variables include land cover types (e.g., forest, desert), climatic attributes (e.g., average winter and summer temperatures), and geographic amenities (e.g., topography, water). Designated natural amenities include protected areas (e.g., National Park, Wilderness) and public land managing agency (e.g., US Forest Service, US Bureau of Land Management). We included built amenities such as infrastructure levels and the presence of a ski resort as these man-made amenities work in concert with natural amenities and land management to provide access to outdoor recreation and destination activities. We did not include social and economic attributes of counties that may be perceived as amenities by some people, such as average per capita income, amount of high-wage service industries, or education levels because we see these types of potential amenities as more of an outcome of being a destination rather than primary reasons leading to amenity-based development.

2.2. Data selection

As noted, our dependent variable (DDS-Destination Development Scale) is adapted from Winkler (2010).[4] The three measures that combine to make up the DDS, net migration rate from 1990 to 2010, percent seasonal homes in 2010, and percent homes over $300,000 in 2010, were all sourced from the U.S. Census, Winkler (2010) and Winkler et al. (2013). In our preferred model, the dependent variable incorporates a 20-year migration rate for every county which can be positive or negative. This 20-year migration rate is actually the average of two decadal net migration rates from 1991 to 2000 and 2001–2010. The dependent variable for our two supplemental models focuses just on five-year migration rates from more urban areas for 1996–2000 and 2006–2010 and uses a measure of seasonal homes from 2000 and 2010 respectively and house values over $200,000 in 2000 and over $300,000 in 2010. Fig. 1 shows the overall DDS range for all rural Western counties and provides a visual illustration of our dependent variable from our preferred model broken into five levels of amenity-based development.

We restricted our analysis to mostly rural counties in the continental American West (excluding very large metro areas), where the majority of public lands exist, and where the amenity migration phenomenon has been most pronounced. Amenity-based development in large metro areas is difficult to determine due to high levels of other economic activities. Rather than rely on one of the many definitions for "rural," "metro," or "non-metro," we used a county population limit of 250,000 people in 2010 as our delineation to account for the wide range in geographic size of Western counties, to account for increases in population since 1980, and to eliminate counties that include very large metro areas despite having a lower county population density.[5] Our county data selection process allowed for greater inclusion of public lands and for a greater sample size. In total, 356 out of 414 total counties in the West were deemed to be mostly rural and without very large metro areas. Table 1 shows the top ten mostly rural Western counties in terms of amenity-based development from our DDS.

For the natural amenities, we started by incorporating county data on climatic and geographic attributes as compiled by McGranahan (1999). Specifically, we included average January and July temperatures, topographic variation, and water area as these climatic and geographic variables have been shown to be strong influencers of amenity migration. Other natural amenities in our analysis included the amount and type of land cover for every county, tabulated in ArcGIS using the National Agriculture Imagery Program (NAIP) data from 2011. Land cover is an important attribute to consider as a potential attractant (or repellent) for amenity migrants and destination areas, as the presence of mountains or forests for example, can influence amenity-based development levels. We used the top five land cover classes for the West of forest and woodland, shrub and herb vegetation, desert and semi-desert, polar and high montane, and agriculture/developed. We expect all climatic and geographic amenities to be fairly constant over time and expect that changes due to climate change are relatively evenly distributed across the continental Western U.S. over the last two decades, though updated climatic variables could help to verify this.[6]

Given the importance of economic access and infrastructure to destinations (Power, 2005; Rasker et al., 2013), we were compelled to include proxies for basic transportation infrastructure, internet infrastructure, and population in our modeling using the county classifications constructed by Headwaters Economics (2015): isolated, connected, and metro.[7] Each county was categorized into one of these three infrastructure/population types and were included as dummy variables in the analysis. The classification of rurality among counties in our study area helps capture a known attribute of migration patterns in the rural West—a creeping suburbanization of non-metro counties adjacent to rapidly growing metro counties (Otterstrom and Shumway, 2003).

Additionally, we included the presence of a ski resort in the county as another built amenity, given that skiing is a major winter attraction in the West. Ski resort data were taken from Wikipedia in 2018 and verified by checking individual ski resort websites. Other built amenities such as recreational infrastructure (e.g., trails, campgrounds, and boat ramps) on public lands can also play a role in a region's amenity-based development. However, we assumed that recreational infrastructure writ large is highly correlated with the amount of public lands in a county and further detail on built recreational infrastructure is beyond the scope of this study.

Designated natural amenities are the county's percentage of area in federal land management agencies and protected areas. While there are

[4] Please see Winkler's (2010) dissertation, pp. 48–52, for a full description of the scale.

[5] Some Western counties are geographically large and contain both large metro areas and vast uninhabitable lands that lead to overall low county population densities despite the presence of major cities (*e.g.*, San Bernadino County and Los Angeles, CA and Pima County and Tucson, AZ). The presence of a large city and a relatively low population density compelled us to use overall county population as the primary filter, removing counties that have a total population greater than 250,000 people.

[6] With increasing effects from climate change in the Western U.S., there is a need to also focus on associated natural disasters such as changing wildfire regimes, summer heat events, and droughts and their effect on migration and destination patterns. The supply and demand for winter skiing, for example, is already being affected by shrinking ski seasons due to climate change.

[7] Please note that the Headwaters "metro" classification of rural counties does not mean that they are metropolitan counties but rather they are more metropolitan than the other rural counties because they tend be adjacent or very close to actual metropolitan counties.

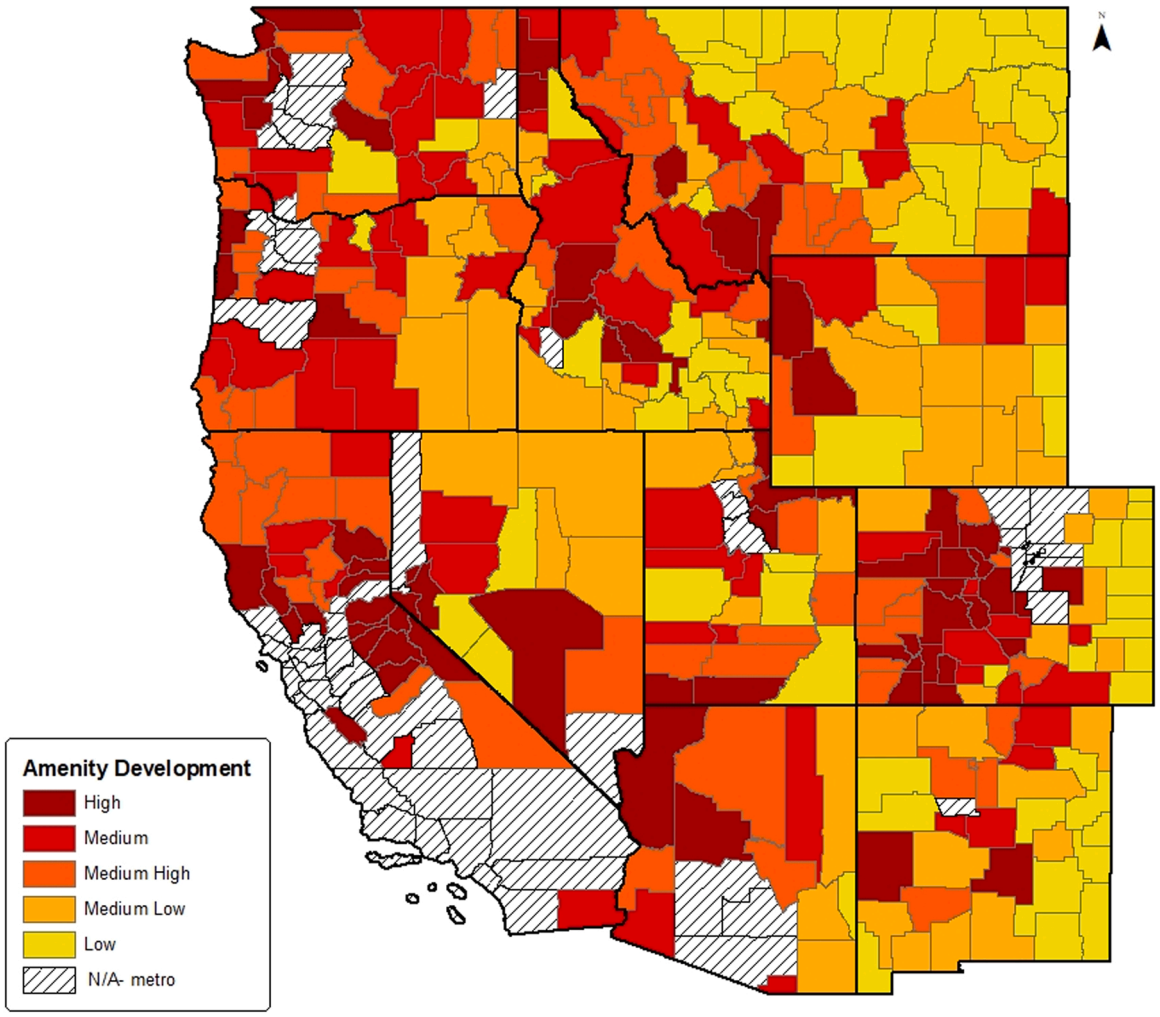

Fig. 1. Destination development level for western rural counties.

Table 1
Top ten most natural amenity developed rural western counties.

County Name	State	Towns/Resorts
1. Summit County	Colorado	Breckenridge, Keystone
2. Summit County	Utah	Park City
3. Eagle County	Colorado	Vail
4. Hinsdale County	Colorado	Lake City
5. San Miguel County	Colorado	Telluride
6. San Juan County	Washington	Friday Harbor, San Juan Islands
7. Teton County	Wyoming	Jackson, Jackson Hole
8. Ouray County	Colorado	Ouray
9. Alpine County	California	Markleeville, Kirkwood
10. Mono County	California	Bridgeport, Mammoth

a number of protected area types that vary in protection intensity, we limited the scope of protected area analysis to what we consider to be the top six most protective federal designations which, in no particular order, are: National Parks, National Monuments, Wilderness Areas, Roadless Areas, Wild and Scenic Rivers, and Wilderness Study Areas. The Protected Areas Database (PAD-US) Version 1.4 data layers from 2016 were used to map all designated natural amenities and to tabulate the percentage of county acres comprised by each (U.S. Geological Survey, Gap Analysis Program (GAP), 2016). In cases of overlapping protected area types, such as portions of a National Park (like Yosemite) that are also designated Wilderness areas, we conducted separate overlays to determine the percentage of each county that is Wilderness and the percentage that is a National Park. While a small portion of protected areas were designated throughout our study time period (1990–2010), we presumed that the desirable landscape characteristics of protected areas, even prior to their official designation, were influential in spurring amenity-based development. Finally, the PAD-US 1.4 data from 2016 were also used to overlay acres managed by various federal land management agencies on top of counties. We restricted our focus to the four federal land management agencies responsible for the greatest amount (in land mass) of protected area management: US Forest Service, National Park Service, Bureau of Land Management, and US Fish and Wildlife Service.[8] Table 2 provides a description of the variables used in the analysis.

2.3. Regression diagnostics

After our original model specification, we examined and tested for outliers starting with leverage plots. Plotting residual-squared versus leverage showed the potential for a couple of outliers but a Cook's Distance test showed no values greater than one. Despite the Cook's Distance test results, we examined the effect of removing one data point with the highest leverage and found no improvements in our model fitness. Thus, no outliers were identified or removed.

[8] US Fish and Wildlife Service lands (as opposed to marine areas) are primarily represented by National Wildlife Refuges, making these two variables collinear.

Table 2
Description of variables used in the regression analysis.

Variable name	Definition	Data Source	Expected sign
Dependent variable: Destination Development Scale	An index combining: 1) two-decade average net migration rate for the county (1990–2010); 2) % of houses greater than $300 K (2010); and 3) % of seasonal homes (2010)	U.S. Census, Winkler (2010), Winkler et al. (2013)	
Explanatory Variables			
Natural amenities (N)			
January Temperature	County average January temperature 1941–1970	McGranahan (1999)	+
July Temperature	County average July temperature 1941–1970	McGranahan (1999)	–
Topography	County topographic variation ranking	McGranahan (1999)	+
Water area	Water area as a % of total county area	McGranahan (1999)	+
Land cover			
Forest and woodland	% of county acres that is forest	NAIP land cover 2011	+
Shrub and herb veg	% of county acres that is shrub	NAIP land cover 2011	?
Desert and semi-desert	% of county acres that is desert	NAIP land cover 2011	?
Polar and high montane	% of county acres that is polar	NAIP land cover 2011	?
Agricultural—developed	% of county acres that is agriculture	NAIP land cover 2011	?
Built amenities (B)			
Infrastructure/Access			
Metro	If county is located near a larger MSA, dummy = 1	Headwaters Economics (2015)	+
Connected	If county is rural but has airport, dummy = 1	Headwaters Economics (2015)	?
Isolated	If county is rural and has limited access, dummy = 1	Headwaters Economics (2015)	?
Ski resorts	If county has a ski resort, dummy = 1	Wikipedia 2018	?
Designated natural amenities (DN)			
Protected areas			
Wilderness Areas	% of county acres that is Wilderness	PAD US version 1.4 2016	+
National Parks	% of county acres that is National Park	PAD US version 1.4 2016	+
Roadless Areas	% of county acres that is Roadless	PAD US version 1.4 2016	?
National monuments	% of county acres that is National Monument	PAD US version 1.4 2016	?
Wild and Scenic Rivers	% of county acres that is Wild and Scenic River	PAD US version 1.4 2016	?
Wilderness Study Areas	% of county acres that is Wilderness Study Area	PAD US version 1.4 2016	?
Land Management			
USFS acres	% of county acres managed by USFS	PAD US version 1.4 2016	+
NPS acres	% of county acres managed by NPS	PAD US version 1.4 2016	+
BLM acres	% of county acres managed by BLM	PAD US version 1.4 2016	?
USFWS acres	% of county acres managed by USFWS	PAD US version 1.4 2016	?

A histogram of our dependent variable indicated a non-normal distribution, exhibiting positive skewness. An investigation of the residuals also illustrated positive skewness and highly significant Chi-squared statistics when estimating a Breusch-Pagan / Cook-Weisberg test for heteroskedasticity and a Jarque-Bera normality test. We found that a logarithmic transformation of our dependent variable substantially reduced Chi-squared values (skewness) and kurtosis but heteroskedasticity still remained. In order to address non-normality of our residuals we conducted final regressions using robust standard errors.

Based on our OLS regression diagnostics, a log-linear model specification proved best at reducing heteroskedasticity in residuals and improving model fitness based on R-squared, AIC, and BIC statistics. Because our dependent variable included negative numbers, we added a constant (1) to all observations prior to transforming to the natural log. Transformations of independent variables did not improve model fitness and we retained our log-linear final specification.

Multicollinearity issues required in depth investigations of variable correlations, especially as the functional model included numerous potential explanatory variables with similarities. For example, the percentage of land in federal land management agencies (e.g. US Forest Service) was found to be highly collinear with land cover attributes (e.g. forest cover). Likewise, a county's portion of national park acres was highly collinear with the portion of National Park Service-managed acres. Thus, we had to identify all collinearity and identify which of the correlating variables to retain. To understand basic relationships and visuals we examined two-way scatterplots with fitted lines between all potential independent variables and the dependent variable as our first source of investigation for collinearity. Additionally, simple regressions were performed to identify association signs and t-statistics. Correlation tables were used to identify numerical associations between variables and variance inflation factors (VIF) and condition numbers were used to check overall multicollinearity. After dropping variables that were highly collinear, our final model had a low mean VIF of 1.46 and a condition number of 12.35 suggesting acceptable levels of multicollinearity (Gujarati, 1998).

Finally, we tested for the presence of spatial dependency in our model. As spatial data can violate standard regression assumptions of observation independence (LeSage, 2014), we investigated the level of spatial autocorrelation, or the coincidence of value similarity with locational similarity (Anselin and Berra, 1998). For example, our measures of counties as a "destination" (i.e., the DDS) could be influenced by omitted variable bias leading to spatial autocorrelation of error terms and could be influenced by amenity attractions associated with neighboring counties resulting in spatial lag (LeSage and Pace, 2009). Accounting for spatial dependence by incorporating spatial weights can limit omitted variable bias and can offset the influence of a neighboring county's amenities.

For modeling purposes, we started with nonspatial OLS regressions and then investigated spatial regressions— the specific-to-general approach described by Elhorst (2014). A highly significant Moran's I test indicated the potential presence of spatial dependency in our model. Robust Lagrange multipliers indicated that spatial error may be present (p-value = 0.011) but that spatial lag is likely less of an issue (p-value =

0.220). Ultimately, both spatial error and lag models were estimated. Additionally, nonspatial regressions were estimated as generalized linear models (GLM) to ascertain common information criteria. Based on the highest log-likelihood and the lowest Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC), the spatial models were preferred over the OLS models and the spatial error model was a better fit than the spatial lag model. Final results presented below are focused on the spatial error models.[9]

3. Results

Our final model included 11 potential explanatory variables, nine of which were significant at the 95% level. Table 3 illustrates the descriptive statistics of all final variables included. The model had a variance ratio of.532 and a squared correlation of .478. The spatial error model was deemed the best fit and we found that varying distance bands had little effect on the final estimates. Based on sensitivity analysis, we found that lesser band ranges exhibited better model fitness and the final band range used was three kilometers.

Based on spatial regression estimates, cool summers, mountains, forests, and water were the natural amenities most highly associated with destination areas and amenity-based development. As July temperatures decrease, the level of amenity-based development increases. As topographic variation and forests increase, so too does amenity-based development. For the built amenities, more populated counties with greater infrastructure were more likely to have a higher amenity-based development score than isolated and remote counties. Ski resorts, while exhibiting a positive association with amenity-based development, were not deemed to be significantly associated with amenity-based development in the rural West. Even though the most amenity developed counties in the West feature ski resorts (see Table 1), and ski resorts were positively significant in our two supplemental DDS models, the overall number of counties with ski resorts is small enough (n = 83) to limit the explanatory power of this variable in our preferred model. Additionally, ski resorts exhibited enough correlation with topography, forest land cover, and cool summers to minimize their impact. In terms of designated natural amenities, Wilderness Areas and National Monuments were the most highly associated protected areas with amenity-based development. Table 4 presents the final spatial regression estimates for our comprehensive model.

Table 3
Descriptive statistics of final regression variables (n = 356).

Variable	Mean	Std. Dev.	Min	Max
Natural log of (1 + Destination Development Scale score)	0.324	0.222	-0.097	0.996
Natural amenities (N)				
July temperature	69.807	6.075	55.500	93.700
Topography	15.682	5.530	1.000	21.000
Water area (%)	0.021	0.061	0.000	0.718
Forest land cover acres (%)	0.321	0.237	0.001	0.846
Built amenities (B)				
Metro (dummy)	0.219	0.414	0.000	1.000
Connected (dummy)	0.216	0.412	0.000	1.000
Isolated (dummy)	0.565	0.500	0.000	1.000
Ski resort (dummy)	0.233	0.423	0.000	1.000
Designated natural amenities (DN)				
Wilderness Area acres (%)	0.050	0.094	0.000	0.617
National Monuments acres (%)	0.005	0.025	0.000	0.259
Roadless Area acres (%)	0.066	0.093	0.000	0.280

Table 4
Spatial error regression results (n = 356).*

Variable	Coef.	Robust Std. Err.	z	P > | z|	Implicit Interpretation
Dependent variable: ln (1 +DDS)					
Natural amenities (N)					
July temperature**	-0.009	0.002	-4.15	0.000	A one degree increase in July temp is associated with a.9% decrease in ln (1 +DDS)
Topography**	0.007	0.002	2.93	0.003	A one unit increase in topography ranking is associated with a.7% increase in ln (1 +DDS)
Water area (%)**	0.006	0.001	2.06	0.000	A 1% increase in water area is associated with a.006% increase in ln (1 +DDS)
Forest cover (%)**	0.197	0.062	3.19	0.001	A 1% increase in forest cover county acres is associated with a.197% increase in ln(1 +DDS)
Built amenities (B)					
Metro (dummy)**	0.067	0.020	3.36	0.001	Metro counties have a 6.70% increase in ln (1 +DDS) compared to counties that are isolated and connected
Connected (dummy)**	0.045	0.022	2.08	0.037	Connected counties have a 4.50% increase in ln(1 +DDS) compared to counties that are isolated and metro
Ski resort (dummy)	0.027	0.023	1.19	0.236	Not applicable
Designated natural amenities (DN)					
Wilderness Areas (%)**	0.364	0.104	3.50	0.000	A 1% increase in Wilderness acres is associated with a.364% increase in ln (1 +DDS)
National Monuments (%)**	0.690	0.299	2.31	0.021	A 1% increase in National Monument acres is associated with a.69% increase in ln(1 +DDS)
Roadless Area (%)	0.229	0.144	1.59	0.111	Not applicable

*Spatial regression statistics includes a variance ratio of .532, a squared correlation of .478, and highly significant Wald and Lagrange multiplier tests for lambda (0.000).
**Statistical significance at the 95% level.

Sensitivity analysis was performed by estimating two supplemental Destination Development Scale models. Spatial error regressions were fit to the two alternate DDS models detailed in the Methods section. The first alternate model (DDS Model 2) employs a dependent amenity-based development variable comprised of seasonal housing from 2000, house values above $200,000 in 2000, and migration from more urban areas from 1996 to 2000 (Winkler's, 2010 original Destination Development Scale). The second alternate model (DDS Model 3) uses seasonal housing

[9] Estimated spatial models incorporated an inverse-distance spatial weights matrix and were insensitive to varying band distances. To avoid greater multicollinearity, we did not include dummy variables for spatial regimes such as individual states in our final spatial regressions.

and house values above $300,000 from 2010, and migration from more urban areas from 2006 to 2010. Table 5 presents the final estimates for both alternate models.

While the natural amenities of cool summers, mountains, forests, and water were all very significantly associated with amenity-based development in the alternate models, along with Wilderness Areas, a few explanatory variables exhibit different influence on the level of amenity-based development based primarily on shortening and constraining the period over which migration rates were measured. Estimates from the alternate DDS models show that the presence of ski resort was highly associated with amenity-based development in the late 1990s and the late 2000s, but when evaluating long-term cumulative migration rates, ski resorts were no longer significant. Likewise, the amount of Roadless Area acres in a county was significantly associated with increased amenity-based development for the supplemental model 3. However, National Monument acres were not significantly associated with either supplemental DDS model but were highly associated with the DDS in our preferred model. Interestingly, the level of a county's infrastructure and adjacency to more urban areas were no longer found to be associated with increased amenity-based development for the supplemental model 3.

In terms of protected areas, Wilderness Areas were most clearly associated with greater levels of amenity-based development while National Monuments and Roadless Areas also exhibited significant and positive associations. Other protected area types, particularly National Parks, also tend to be associated with greater levels of amenity-based development in a county but were removed from final spatial regressions due to collinearity with other stronger explanatory variables. In fact, simple comparisons of amenity-based development level for counties with and without each protected area type reveal that counties containing specific protected area types had higher levels of amenity-based development than rural Western counties without those protected area types (see Fig. 2).

4. Discussion

We found that protected areas are associated with greater levels amenity-based development throughout the West. The relationships illustrated that not only does the presence of protected areas correlate with greater amenity-based development, more importantly, the size and number of protected areas is positively associated with amenity-based development. That is, the larger the Wilderness area or National Monument, the greater the level of amenity-based development. Large blocks of connected protected areas create regional destination clusters in the West (see Fig. 1). Destination clusters can result from counties with larger amounts of public (and protected) lands having increased economic demands on the available, and more limited, private property and developable land. These land constraints on development can also contribute to increased housing costs and can influence adjacent counties as illustrated by our spatial dependency findings.

It is notable that cool summertime temperature is the most influential climatic feature of amenity-based development in the rural West. This is in contrast with overall amenity *migration* explanatory variables where warm winters were the most influential climatic attribute (McGranahan, 1999; Hjerpe et al., 2020). The difference in temperature influences between amenity migration and amenity-based development in the rural West is indicative of couple things. First, Western amenity migration has a large component of retirees searching for increased quality of life as they get older that often includes moving to a warmer location. On the other hand, Western amenity-based development had a low, but positive, correlation with retirement destinations indicating that retirees are not a primary driver of amenity-based development like they are for general amenity migration. Lifestyle preferences for destination seekers, such as skiing[10] and escaping increasingly hot city climates, likely account for these differences in amenity-based development and migration.

Amenity-based development depends on several factors, some of which are within human control. Natural amenities such as cool summers, mountains, forests, and water are all associated with greater levels of amenity-based development but cannot be largely altered in the short term by policies or other human actions.[11] The influence of natural amenities on development likely depends upon accessibility, which is influenced by policies including public ownership and protective designations such as Wilderness or National Monuments. Since protected areas are an amenity-based development factor under human control, there is an opportunity to align protected area policies with development and land use planning outside of protected areas. In other words, protected areas affect adjacent development and likewise, adjacent development affects protected areas. This indicates an opportunity, albeit a challenging one, for federal level policy to be responsive to local planning and vice versa.

Fundamentally, there is value in proactive planning in rural Western gateway communities (Stoker et al., 2020); a need exacerbated by the COVID-19 pandemic, which has driven demand for rural, idyllic locales. Land use policies and zoning can be important tools that affect the trajectory of rural development, especially adjacent to protected areas, but misalignment in zoning policies across jurisdictions such as between municipalities and counties can decrease zoning effectiveness (Bergstrom and Harrington, 2019). Zoning for ecological buffers can help insulate protected areas from the threats of rapid development (e.g., adjacent air and water pollution, loss of habitat connectivity). Conservation credits and land easements can incentivize more sustainable development and the protection of open spaces. Impact fees, or local government surcharges for shared infrastructure and service needs created by new development such as road maintenance, wastewater services, or emergency services (Morton et al., 2022), can be levied on new residential and tourism development to make sure that tourists and second-home owners pay for the full suite of services needed to safely, efficiently, and equitably provide access to protected areas (Kondo et al., 2012; Jiang and Swallow, 2017). Further, as would-be amenity migrants begin to understand the potential costs of rapid development (e.g., rural sprawl), they may consider not only natural amenities as attractive, but also local land use and zoning policies. That is, as people search for the "next best place," innovative policies balancing conservation and development might become desired social amenities in their own right, attracting like-minded individuals willing to pay for sustainable and more deliberately planned development.

Natural amenity arbitrage with rural housing and property markets occurs, particularly among those focused on property ownership as an investment. This type of spatial arbitrage results when people geographically relocate, or remotely change ownership, from one area to another with similar amenities yet lower property costs (e.g., selling a house in California and buying a house in, *as of now*, lower-priced Idaho). Combining natural amenity arbitrageurs with people moving from higher-priced metro areas to lower-priced rural hinterlands,

[10] While the presence of ski resorts did not make the significance threshold for our long-term preferred DDS model, it was a positive and significant attribute for both supplemental DDS models.

[11] As noted by a reviewer, the seasonal nature of activities spurred by these climatic and geographic explanatory variables (e.g., winter skiing, summer boating) indicate the highly seasonal nature of amenity destinations. Future research on seasonality as a potential influencer of a region's amenity-based development level would be valuable.

Table 5
Spatial error regression results for DDS models 2 and 3 (n = 356).

Variable	Model 2: DDS 1996–2000				Model 3: DDS 2006–2010			
Dependent variable	*ln (DDS1996–2000)*				*ln (DDS2006–2010)*			
	Coef.	Robust Std. Err.	z	P > |z|	Coef.	Robust Std. Err.	z	P > |z|
Natural amenities (N)								
July temperature	-0.022	0.006	-3.94	0.000*	-0.028	0.006	-5.02	0.000*
Topography	0.021	0.007	3.19	0.001*	0.027	0.007	3.77	0.000*
Water area (%)	0.017	0.004	4.15	0.000*	0.020	0.004	4.83	0.000*
Forest cover (%)	0.463	0.181	2.56	0.010*	0.690	0.175	3.94	0.000*
Built amenities (B)								
Metro (dummy)	0.264	0.056	4.72	0.000*	0.081	0.058	1.38	0.167
Connected (dummy)	0.046	0.058	0.79	0.427	0.052	0.058	0.88	0.377
Ski resort (dummy)	0.123	0.054	2.29	0.022*	0.113	0.057	1.96	0.050**
Designated natural amenities (DN)								
Wilderness Areas (%)	0.857	0.269	3.18	0.001*	1.009	0.262	3.85	0.000*
National Monuments (%)	1.118	0.941	1.19	0.235	1.376	1.138	1.21	0.227
Roadless Area (%)	0.234	0.453	0.52	0.605	0.655	0.397	1.65	0.099**

*Statistical significance at the 95% level.
** Statistical significance at the 90% level.

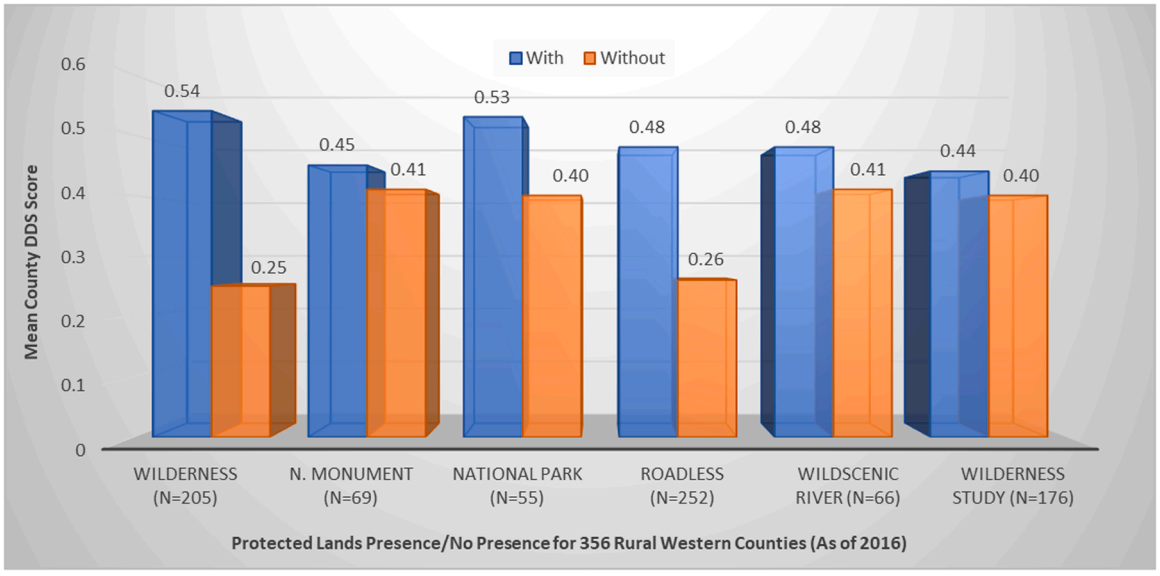

Fig. 2. Average county level of amenity-based development with/without protected areas.

creates a class of new residents sometimes referred to as equity migrants.[12] As access and technological advances allow for greater mobility and investment potential, amenity arbitrage is increasing. Furthermore, the COVID-19 pandemic is helping catalyze greater economic demand for rural housing leading to speculators and investors shifting real estate money to more affordable regions. In the end, amenity arbitrage will lead to rapid increases in housing and property costs in the next best places, or those amenity-rich regions that have remained largely undeveloped.

With data available on the direction to and from places where people are relocating, there would be value in new research on amenity arbitrage that tabulates the percentage of people moving from a place with a higher cost of living to a cheaper rural area. When applied to amenity-rich rural regions with protected areas, an economic demand curve can illustrate a partial market value of access to adjacent public lands. The equity migrant phenomenon can also be paired with analytical investigations of affordable housing in regional destinations. For example, of residents earning median wages, what percentage can afford housing in that region?

4.1. Conclusion

Understanding the natural and designated amenities that influence the economic demand for rural destinations can inform regional planning efforts, helping to prioritize policies that balance conservation and development. Future research is needed to further investigate the relationship between protected areas and amenity-based development. In particular, data collection on adverse effects of amenity-based development such as congestion, ecological degradation, and net losses of open space and native biodiversity should be paired with the current economic descriptors of destinations to identify any relationships between the ecological health of protected areas and the level of amenity-based development.

Future research within the context of amenity-based development considering trend analysis would also help with planning. Often, destination communities are planning reactively to rapid growth, and we believe that our research, given its methods and the potential for prediction, might help forecasting and, thus, proactive planning.

[12] Equity as used here is referring to the accrued wealth associated with increased property values.

Quantitative amenity-based development indicators, such as the Destination Development Scale, can be used for relative comparisons over time to illustrate which regions are the next likely boom towns. These regions now have more information with which to anticipate their future development, allowing for advanced land planning. Given international findings of public lands and open space as being influential for amenity migration, our amenity-based development assessment is likely applicable to any region that contains protected areas. But given the uniqueness and dramatic nature of much of the American West and associated protected areas, we surmise that research focusing on other regions with different, possibly less dramatic, natural amenities might reveal that different attributes (e.g., greater socio-cultural amenities), may be more influential in driving amenity-based development patterns (Nelson, 2006).

For future research, there is potential benefit of better understanding the distributional effects of amenity-based development benefits, especially given the relationship to protected areas. That is, Western protected areas are owned by the public yet contribute to unique economic benefits realized by gateway communities and their associated amenity-based development. A case can be made that the distribution of these benefits, in part stemming from public lands, is inequitable and inefficient in places where access to visit, live, or work adjacent to protected areas can be financially prohibitive for most. Additionally, higher resolution research on rural amenity-based development and protected areas would be beneficial. Our county level data revealed broad, yet robust, patterns on influencing amenities. Matching census-level or zip code-level economic data with protected area adjacency would allow for refinements in understanding how protected area policies might be more sustainable and equitable and could provide a better match for regional planning that often happens at the minor civil division scale (e.g., Kim and Marcouiller, 2021).

Finally, understanding relationships between protected areas and amenity-based development requires increased communication across academic disciplines, particularly between economists, geographers, sociologists, and ecologists. With substantial, but typically siloed, research in the arenas of conservation and amenity migration, the potential for integrative research is high. For example, the economic-centered research presented in this manuscript could be paired with the knowledge related to perceptions of different types of residents toward community development and change (e.g., Ulrich-Schad, 2018, Park et al., 2019, Stiman, 2020). If we can forecast places that might see amenity-based development, particularly as protected area designations are weighed, then maybe there are lessons from the social sciences that can help plan for development that is more socially acceptable and sustainable.

Conflict of interest

The authors declare that they have no conflict of interest.

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